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TECHNICAL MEMORANDUM RISK SUMMARY FOR SITE 7 NAB LITTLE CREEK VA

8/8/2000

CH2MHILL

Risk Summary for Site 7 (Former Beryllium Landfill)

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Introduction and Purpose

This memorandum has been prepared to evaluate the potential risks to human health and the environment from soil and groundwater at Site 7, the Former Beryllium Landfill, at the Allegany Ballistics Laboratory (ABL) in Rocket Center, West Virginia.

The analytical results for confirmatory soil samples collected during the removal actions and groundwater samples collected during previous investigations conducted at Site 7 were compared to regulatory screening levels (as shown in Tables 1 and 2, respectively). This memorandum provides a comprehensive overview of the constituents detected above regulatory screening levels in site media, potential ecological and human receptors that have been identified, any existing exposure pathways to the receptors, and potential risks to the identified receptors.

Site Background

Site 7, the Former Beryllium Landfill, is reported to have been a small pit formerly used to dispose of beryllium-contaminated waste and unidentified laboratory waste chemicals. The former landfill is located southwest of Plant 1, and east of Site 5 on the western flank of Knobly Mountain. It is situated directly south of the main administration building, Building 300, and adjacent to State Route 956, as shown in Figure 1-1. Potential contaminants detected in soil and groundwater at Site 7 were inorganics (specifically beryllium), volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). Landfill contents were removed in 1994 to address any environmental concerns related to human health and the environment.

Nature and Extent of Contamination

Soil

During the removal of landfill contents at Site 7, one confirmatory soil sample was collected from the bottom and each side of the excavation to determine when sufficient soil had been removed. These five soil samples were analyzed for Target Compound List (TCL) VOCs, SVOCs, and pesticides/polychlorinated biphenyls (PCBs), and for Target Analyte List (TAL) metals. The analytical results for detected constituents were compared to the U. S.

Environmental Protection Agency (USEPA), Region III residential and industrial Risk-based Concentration (RBC) screening criteria and soil screening levels (SSLs), to flora and fauna Biological Technical Assistance Group (BTAG) screening criteria for soil, and to inorganic background concentrations. The results of this comparison are presented in Table 1. The sample collected from the bottom of the excavation (B005) had a mercury concentration (35.2 mg/kg) above several USEPA screening criteria. Therefore, an additional 5 cubic yards of soil were removed from the bottom of the excavation and a second confirmatory sample (i.e., B005-2) was collected from the bottom of the excavation for mercury analysis only.

No pesticides or PCBs were detected in the confirmatory soil samples. Two VOCs (i.e., acetone and methylene chloride) and one SVOC (i.e., bis(2-ethylhexyl)phthalate) were detected in the confirmatory soil samples below all applicable regulatory screening levels.

Nineteen inorganics were detected in the confirmatory soil samples. Antimony was the only inorganic constituent not detected or detected but qualified with a "B" flag, indicating similar concentrations to that detected in quality control/quality assurance (QA/QC) samples. Therefore, antimony was not considered further in the screening process.

As shown in Table 1, 11 inorganic constituents were detected above one or more human health or ecological screening criteria (as indicated by shading the boxes containing the regulatory screening criteria). These are aluminum, arsenic, beryllium, chromium, iron, lead, manganese, mercury, nickel, vanadium, and zinc. Of these, five constituents (i.e., aluminum, arsenic, beryllium, iron, and mercury) exceeded residential RBC screening levels. No inorganic constituents were detected above industrial RBC screening levels.

The concentration of aluminum detected in the first confirmatory soil sample collected from the bottom of the excavation was the only exceedance of the residential RBC screening level for aluminum. This aluminum concentration also was above the BTAG screening criterion for fauna. All aluminum concentrations detected in the five confirmatory soil samples were below the background soil concentration for the facility and the background concentration range for the State of West Virginia (from WV 60 CSR 1).

Arsenic was detected in two confirmatory soil samples above the USEPA Soil Screening Level (SSL) for leaching to groundwater. However, the concentrations of arsenic detected were consistent with background soil concentrations at the facility and were below the background concentration range for the facility and State of West Virginia (from WV 60 CSR 1). It also should be noted that several of the arsenic results are qualified with a "B" flag, indicating similar concentrations to that detected in QA/QC samples. In addition, arsenic was detected below the BTAG screening criterion for fauna.

As previously mentioned, the mercury concentration in the first confirmatory soil sample (i.e., B005) collected from the bottom of the excavation exceeded the residential RBC. The mercury concentration in the second confirmatory sample (i.e., B005-2), collected after removing additional soil, did not exceed the residential RBC. In general, mercury concentrations detected in the samples collected from bottom (B005-2) and walls of the excavation were slightly higher than the facility background concentration for mercury; however, they were within the background concentration range for the State of West Virginia (from WV 60 CSR 1). Mercury was detected above BTAG screening criteria for both flora and fauna in all confirmatory soil samples collected.

Beryllium was detected above the residential RBC and facility background only in the first confirmatory soil sample collected from the bottom of the excavation. Beryllium concentrations detected in the confirmatory soil samples collected from the walls of the excavation were consistent with background concentrations for the facility and State of West Virginia (from WV 60 CSR 1). Beryllium was detected above the BTAG screening criteria for fauna in all confirmatory soil samples.

Iron was detected above the residential RBC in three of the five confirmatory soil samples collected. Iron also was detected above BTAG screening criteria for flora and fauna in all confirmatory soil samples collected, but the concentrations were consistent with background iron concentrations for the facility and State of West Virginia (from WV 60 CSR 1).

Six inorganic constituents (i.e., chromium, lead, manganese, nickel, vanadium, and zinc) were detected above one or more ecological screening level only. Additionally, manganese was detected above the USEPA SSL for leaching to groundwater. However, all six of the aforementioned inorganics were detected below inorganic background concentrations for the facility and/or the State of West Virginia (from WV 60 CFR 1).

Groundwater

One groundwater monitoring well (i.e., 7GW1), screened within the bedrock aquifer, exists at the site. The well was sampled once on October 18, 1992 for VOCs, explosives, and total inorganics as documented in the *Remedial Investigation Report for Allegany Ballistics Laboratory* (CH2M HILL, January 1996). The analytical results of detected constituents were compared to RBC screening criteria for tap water and USEPA maximum contaminant levels (MCLs). The results of this comparison are presented in Table 2. No VOCs or explosives were detected in the groundwater; fifteen inorganics were detected. Three inorganics (i.e., aluminum, antimony, and iron) were detected at concentrations exceeding USEPA MCLs. Antimony was the only constituent detected above the RBC screening criterion for tap water. The concentration of antimony detected is flagged with a "J", indicating that the result is estimated because it was detected below the instrument quantitation limit.

Beryllium is the primary constituent of potential concern at Site 7. Beryllium was detected in well 7GW1 (i.e., 0.54 µg/l) at two orders of magnitude below the RBC screening criteria for tap water (i.e., 73 µg/l) and one order of magnitude below both the USEPA MCL (i.e., 4.0 µg/l) and BTAG ecological screening level in fresh surface water (i.e., 5.3 µg/l).

RISK SUMMARY

The threat to human health and the environment from existing constituents in Site 7 media is considered very low because of the landfill removal activities conducted in 1994. Described below are the potential risks associated with the remaining constituent concentrations and the long-term reliability for continued protection.

Potential exposure to remaining risks: The contents of the Site 7 landfill were excavated until the soil was visibly free of containers (vials) and debris. Confirmatory soil samples of the walls and bottom of the excavation were collected and the results were compared to industrial RBC screening criteria (USEPA, April 1995) and used to determine when the removal action was sufficient. The sample collected from the bottom of the excavation was the only confirmatory sample that contained a constituent, mercury, which exceeded the concentration listed in the April 1995 RBC table. Therefore, an additional 5 cubic yards of

soil were excavated from the bottom of the excavation and a second confirmatory sample was collected from the bottom of the excavation for mercury analysis. The result of this sample analysis was below the concentration listed in the RBC table for a 10^{-6} risk and, therefore, no further soil removal was performed and the excavation was backfilled with clean fill material. The TCL/TAL constituents remaining in the soil are below current USEPA industrial RBC screening levels. The potential for migration and exposure through the groundwater pathway was significantly reduced with the removal of landfilled materials.

Four inorganic constituents (i.e., aluminum, arsenic, beryllium, and iron) were detected at concentrations exceeding residential RBC screening criteria (see Table 1). The concentrations of aluminum, arsenic, and iron are consistent with background soil concentrations for the facility and with the background concentration ranges for State of West Virginia (from WV 60 CSR 1). Therefore, aluminum, arsenic, and iron do not pose a risk above that of background levels to human health and the environment at Site 7.

Beryllium was detected in soil collected from the bottom of the excavation (i.e., first confirmatory soil sample at a depth of 6 feet) at a concentration that exceeded the residential RBC. None of the other confirmatory soil samples collected contained beryllium above the residential RBC. Therefore, when considered collectively with the other soil at the site, the human health risk associated with the site is within acceptable levels. Furthermore, as noted previously, additional soil was removed following analysis of the first confirmatory soil sample from the bottom of the excavation.

A site conceptual model was evaluated to identify potential ecological receptors and pathways at the site. Based upon this evaluation, no aquatic habitats were found to occur in the vicinity of Site 7 and no complete exposure pathways currently exist at the site. The area of soil contamination was small and isolated, the waste has been removed, and there is no evidence of surface transport pathways to surrounding habitats. Transport of constituents to groundwater also is unlikely based upon the small amount of waste disposed of in the landfill, the geology at the site, and available groundwater data.

Long-term reliability for continued protection: Material excavation and proper disposal provided the most reliable long-term protection by removing the source of contamination from the site to a level protective to human health and the environment. Source removal prohibits further migration of contamination and eliminates the need for further contaminant controls.

TABLE 1
Excavation Delineation Soil Sample Analytical Results

Chemical	Screening Criteria					Sample Results					Background Levels	
	Residential RBC for Soil	Industrial RBC for Soil	SSL for transfer to groundwater	BTAG Soil Flora	BTAG Soil Fauna	B005	E002	N001	S003	W004	Facility Inorganic Background UTL[a]	State Background Concentration Range[b]
Volatile Organic Compounds (ug/kg)												
Acetone	7.8×10^5	2×10^7	2.5×10^3	---	---	4.93 BJ	9.4 B	8.8 B	8.84 B	9.59 B	---	---
Methylene Chloride	8.5×10^4	7.6×10^5	19	200	200	2.29 J	ND	ND	ND	2.12 J	---	---
Semivolatile Organic Compounds (ug/kg)												
Bis(2-ethylhexyl)phalate	4.6×10^4	4.1×10^5	2.9×10^6	5,008	5,008	96.7 J	1,040	828	1,530	2,820	---	---
Inorganic Compounds (mg/kg)												
Aluminum	7.8×10^3	2×10^5	---	---	1	8,390	1,250	7,590	7,390	7,140	27,976	50,000 – 100,000
Antimony	3.1	82	13	---	0.48	ND	ND	1.9 B	ND	ND	5.7	< 1 – 8.8
Arsenic	0.43	3.8	0.026	---	328	2.66	ND	2.38 B	2.58	2.98 B	15	5.9 – 13
Barium	5.5×10^2	1.4×10^4	2.1×10^3	440	440	61.8	99.6	68.2	78.5	85.5	407	300 – 500
Beryllium	16	4.1×10^2	1.2×10^3	---	0.02	60.27	1.19	1.4 B	1.06	0.962	1.5	ND – 2
Calcium	---	---	---	---	---	7,390	3,720	2,470	2,360	2,140	67,000	400 – 2,500
Chromium[c]	23	610	42	0.0075	0.02	12	14.9	16.6	9.82	13.5	29	30 – 70
Cobalt	4.7×10^2	1.2×10^4	---	200	100	10.2	15.2	14	8.08	12.8	24	7 – 20
Copper	3.1×10^2	8.2×10^3	1.1×10^4	---	15	10.7	14	11.6	7.14	6.49	37	15 – 30
Iron	2.3×10^3	6.1×10^4	---	12	3,260	25,400	30,700	27,500	17,800	19,500	46,212	15,000 – 70,000
Lead	400*	---	---	0.01	2	17.2	20.1	19.7	18.4	22.2	29	10 – 20
Magnesium	---	---	---	4,400	4,400	544	837	623	374	344	2,730	2,000 – 5,000
Manganese	1.6×10^3	4.1×10^4	9.5×10^2	330	330	471	415	873	671	1,160	5,124	300 – 1,500
Mercury[d]	2.3	61	---	0.058	0.058	35.2	0.163	0.288	0.363	0.068	0.06	0.02 – 0.44
Nickel	160	4.1×10^3	---	2	2	9.39	16	13.9	5.85	5.5	30	15 – 30
Potassium	---	---	---	---	---	688	844	608	520	498	1,880	8,100 – 18,700
Sodium	---	---	---	---	---	12.5	18.5	13.9	14.8	14.7	87	1,500 – 7,000
Vanadium	55	1.4×10^3	5.1×10^3	58	0.5	20.1	22.2	19.3	17.3	20.6	43	30 – 100
Zinc	2.3×10^3	6.1×10^4	1.4×10^4	---	10	23.9	26.7	24.4	17.2	15.4	149	40 – 98

RBC = EPA Region III Risk-Based Concentration (4/13/00), noncarcinogenic compounds were screened using a HQ = 0.1

SSL = USEPA Soil Screening Levels, April 13, 2000 – soil migration to groundwater with a dilution-attenuation factor of 20.

BTAG = USEPA Region III Biological Technical Assistance Group screening levels (USEPA, 1995)

[a] – Background concentrations derived from subsurface soil UTLs calculations (CH2M HILL, March 6, 2000).

[a] – Background concentrations derived from subsurface soil Upper Tolerance Limit (UTL) calculations (CH2M HILL, March 6, 2000).

[b] – Background concentrations for the State of West Virginia based upon Shacklette & Boerngen (1984).

[c] – The screening levels for Chromium IV were used to evaluate the risk for total chromium at the site.

[d] – The USEPA soil screening criteria for mercuric chloride was used for mercury.

* = EPA residential lead soil action level (USEPA, December 1996).

--- = No screening criteria available

J = Estimated concentration below the quantitation limit

B = Compound detected in blank and quantity reported is not 5-10 times greater than that found in the blank

ND = Not Detected

Shading indicates that the compound was detected above the screening level but below the background level.

TABLE 2
Analytical Results of Detected Constituents in Groundwater

Constituent	7GW1 (10/92)	Tap Water RBC[a]	EPA MCL
Inorganic Constituents (mg/l)			
Aluminum[b]	**0.731**	3.7	0.05 – 0.2
Antimony	**0.012 J**	0.0015	0.006
Arsenic	ND	4.5×10^{-5}	0.05
Barium	0.185 J	0.26	2.0
Beryllium	5.4×10^{-4} J	7.3×10^{-3}	0.004
Calcium	126	---	---
Chromium[cd]	6.0×10^{-3} J	0.011	0.1
Cobalt	ND	0.22	---
Copper[b]	3.6×10^{-3} J	0.15	1.3
Iron[b]	**0.52**	1.1	0.3
Lead[b]	ND	---	0.015
Magnesium	11.1	---	---
Manganese[b]	0.039	0.073	0.05
Mercury[b]	9.0×10^{-5} J	1.1×10^{-3}	0.002
Nickel	7.7×10^{-3} J	0.073	0.1
Potassium	2.91 J	---	---
Sodium	6.78	---	---
Vanadium	ND	0.026	---
Zinc	4.75×10^{-2}	1.1	---

[a] –Tap Water Risk-based Concentration Limits are from USEPA Region III Risk-Based Concentration Table (4/13/00), noncarcinogenic compounds were screened using a HQ = 0.1

[b] – Secondary Maximum Contaminant Levels (MCLs) were used to evaluate risk for this compound.

[c] – The MCL for total chromium was used to evaluate risk.

[d] – The USEPA tap water RBC for chromium IV was used to evaluate risk.

--- = Screening criteria not available

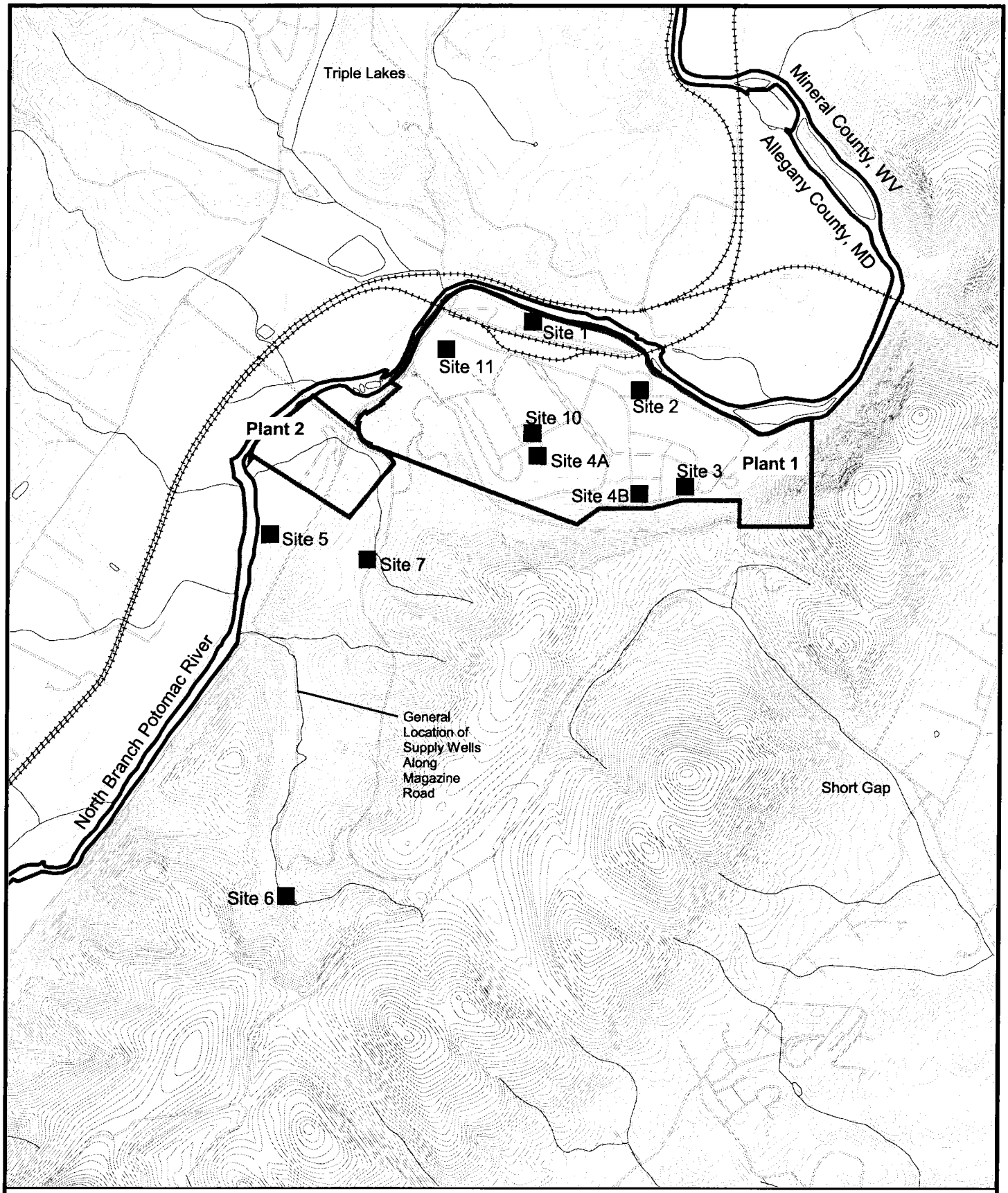
A bold value represents a concentration detected in exceedance of at least one screening value.

A shaded area represents an exceedance of the particular criterion.

J – Concentration is estimated; response was below the lowest standard but greater than zero.

B – This compound was detected in an associated blank.

ND -This compound was not detected in the analysis



Source: USGS 7.5 minute Cresaptown, WV-MD digital quadrangle map

N
W E
S

One Inch Equals
Two Thousand Feet

Figure 1-1
Facility, Plant, and Site Locations
Allegany Ballistics Laboratory

CH2MHILL

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References

CH2M HILL. Draft ABL Background Metals Evaluation Technical Memorandum. March 6, 2000

CH2M HILL. Remedial Investigation of the Allegany Ballistics Laboratory. January 1996.

Shacklette, H. T. and J. G. Boerngen. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. United States Geological Survey Professional Paper 1270. 1984.

United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. Directive 9200.4-27P. December 1996.

United States Environmental Protection Agency, Region III. Revised Region III BTAG Screening Levels. August 9, 1995.

United States Environmental Protection Agency, Region III. Risk-Based Concentration Table. April 13, 2000.

United States Environmental Protection Agency, Region III. Risk-Based Concentration Table. April 1995.